



DEGREE CURRICULUM

# UNIT OPERATIONS OF CHEMICAL PROCESSES

Coordination: GARVIN ARNES, ALFONSO

Academic year 2023-24

# UNIT OPERATIONS OF CHEMICAL PROCESSES 2023-24

## Subject's general information

Subject name	UNIT OPERATIONS OF CHEMICAL PROCESSES			
Code	14523			
Semester	1st Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Character	Modality
	Master's Degree in Industrial Engineering	1	COMPULSORY	Attendance-based
	Master's Degree in Industrial Engineering	2	COMPULSORY	Attendance-based
Course number of credits (ECTS)	6			
Type of activity, credits, and groups	Activity type	PRAULA		TEORIA
	Number of credits	3		3
	Number of groups	1		1
Coordination	GARVIN ARNES, ALFONSO			
Department	FOOD TECHNOLOGY, ENGINEERING AND SCIENCE			
Teaching load distribution between lectures and independent student work	Classrom Work: 60h Independent student work: 90h			
Important information on data processing	Consult <a href="#">this link</a> for more information.			
Language	Catalan: 80 % Spanish: 20 %			
Distribution of credits	Theory: 2 Problems: 4			

# UNIT OPERATIONS OF CHEMICAL PROCESSES 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
GARVIN ARNES, ALFONSO	alfonso.garvin@udl.cat	0	
GARVIN ARNES, ALFONSO	alfonso.garvin@udl.cat	6	

## Subject's extra information

A unit operation is each one of the steps that can be found in any industrial process (whether chemical or not).

This subject studies the most usual and important unit operations in the chemical industrial processes. So, it will consist of applying the Process Engineering to Chemical processes. All the concept that will be studied will be able to be used in any industrial process: food, biotechnology, chemist, etc.

The unit operations studied are the following:

- Distillation
- Solid/Liquid Extraction
- Humidification / Dehumidification / Drying

## Learning objectives

The main aim of this subject is to know the classification of all the unit operations along with the physical-chemical fundamentals and the mathematical models for the most important unit operations involved in the chemical industry.

1. To know the classification of all the unit operations as a function of the property transferred: mass, energy, mass-energy, momentum and other complementary unit operations.
2. To know how the following unit operations work:
  1. Distillation
  2. Solid-liquid extraction
  3. Drying
3. To know the fundamentals of each unit operation.
4. To know the magnitudes, nomenclature and units for each unit operation.
5. To know how to obtain and work with the mathematical models for both each unit operation and each operation mode.
6. To know how to use the mathematical models so as to solve numerical problems related to the design and operation of the equipment needed for each unit operation.

## Competences

Basic competences:

- **CG6.** To have suitable knowledge of the scientific and technological issues of: mathematical, analytical and numerical methods in engineering, electrical engineering, energetic engineering, chemical engineering, mechanical engineering, mechanics of continuous means, industrial electronics, automation, manufacture, material, quantitative methods of management, industrial computing, urbanism, infrastructures, etc.
- **CB3.** To be able to integrate knowledge and face complexity in order to make judgements from an information that, being incomplete or limited, it would include issues of social and ethical responsibilities directly related to the application of this knowledge and judgements.
- **CG7.** To project, calculate and design products, processes, installations and plants.
- **CG9.** To do research, development and innovation in products, processes and methods.

General Competences EPS:

- **CG2.** Capacity to consider the socioeconomic context as well as the sustainability criteria in the engineering solutions.

Specific competences set in ORDEN CIN/311/2009:

- **CE4.** Capacity for the analysis and design of chemical processes.
- **CE7.** Capacity to design electronic and industrial instrumentation systems.

Cross-disciplinary UDL competences:

**CT1.** Appropriate skills in oral and written language.

## Subject contents

0.- Introduction. Classification of unit operations.

1. Air-water interaction
  1. Introduction
  2. Parameters for a humid air
  3. Psychrometric graphics
  4. Humid temperature
  5. Adiabatic saturation
  6. Equation system to obtain every parameter for a humid air

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7. Condensation
8. Height effect
2. Drying process
  1. Introduction
  2. Mass and energy balances
  3. Drying mechanisms
    1. Constant Drying rate
    2. Decreasing Drying rate
  4. Drying rate and time needed:
    1. Drying big solids
    2. Drying granular solids
3. Chemical reactors
  1. Introduction. Chemical reactions. Chemical kinetics.
  2. Batch reactor.
  3. Plug flow reactor.
  4. Stirred tank reactor.
  5. Real reactor.

## Methodology

- Master classes: the concepts are introduced by the professor without the active participation of the students, although, obviously the students can ask as many questions as they need so as the exposed concepts sink in.
- Problems resolution: the professor introduce a complex question with the aim that all the students and the very professor can solve it together in the same classroom.

## Development plan

Week	Method	Subject	Class Time	Student Time	Professor
1	Master Class	0. Introducció	4	6	A. Garvín
2-3	Master Class	T1	8	12	A. Garvín
4-5	Practical Cases	T1	8	12	A. Garvín
6-7	Master Class	T2	8	12	A. Garvín
8-9	Practical Cases	T2	8	12	A. Garvín
10	Written Test				A. Garvín
11-17	Master Class	T3	10	15	A. Garvín
11-17	Practical Cases	T3	14	21	A. Garvín
18	Written Test				A. Garvín

## Evaluation

### Continuous assessment:

Bloc	Activity	Description	%	Date	Rec
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1	Exam Partial 1	Problem Subject 1	25	Official Date Exam Partial 1	YES
2	Exam Partial 1	Problem Subject 2	25	Official Date Exam Partial 1	YES
3	Exam Partial 2	Problem Subject 3 Problem Subject 3	50	Official Date Exam Partial 2	YES

## Resit Exam:

Bloc	Activity	Description	%	Date	Rec
1		Problem Subject 1	25		YES
2	Resit Exam	Problem Subject 2	25	Official Date Resit Exam	YES
3		Problem Subject 3 Problem Subject 3	50		YES

## Alternative assessment (it replaces the continuous assessment):

Bloc	Activity	Description	%	Date	Rec
1		Problem Subject 1	25		YES
2	Exam Partial 2	Problem Subject 2	25	Official Date Exam Partial 2	YES
3		Problem Subject 3 Problem Subject 3	50		YES

If needed, every bloc can have a resit. In that case, the resit exam will follow the table above.

## Bibliography

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